

# METHOD AND APPARATUS FOR PROVIDING A FIXED RELIEF TOUCH SCREEN WITH LOCATING FEATURES USING DEFORMABLE HAPTIC SURFACES

## FIELD

**[0001]** The exemplary embodiment(s) of the present invention relates to a field of electronic interface devices. More specifically, the exemplary embodiment(s) of the present invention relates to a user interface device with haptic feedback.

## BACKGROUND

**[0002]** As computer-based systems, appliances, automated teller machines, point of sale terminals and the like have become more prevalent in recent years, the ease of use of the human-machine interface is becoming more and more important. Such interfaces should operate intuitively and require little or no training so that they may be used by virtually anyone. Many conventional user interface devices are available on the market, such as the key board, the mouse, the joystick, and the touch screen. One of the most intuitive and interactive interface devices known is the touch panel, which can be a touch screen or a touch pad. A touch screen includes a touch-sensitive input panel and a display device, usually in a sandwich structure and provides a user with a machine interface through touching a panel sensitive to the user's touch and displaying content that the user "touches." A conventional touch pad is a small planar rectangular pad, which can be installed near a display, on a computer, an automobile input device, and the like.

**[0003]** A conventional touch-sensitive panel typically has a smooth flat surface and uses sensors such as capacitive sensors and/or pressure sensors to sense locations being touched by a finger(s) and/or an object(s). For example, a user presses a region of a touch screen commonly with a fingertip to emulate a button press and/or moves his or her finger on the panel according to the graphics displayed behind the panel on the display device. Once the input(s) are sensed, the sensed input(s) are forwarded to a processor for processing.

**[0004]** A problem associated with the conventional touch-sensitive panel is that it does not provide relief information to the user. For example, a typical touch-sensitive panel has a smooth and flat surface and consequently, a user can not feel the edge(s) of a button. Another problem associated with the conventional touch-sensitive panel is the inability to provide input confirmation when a user enters an input. For example, when a user presses a location on a conventional touch-sensitive panel, the panel typically does not have the capability to confirm the selected input instantaneous. As such, lack of locating features such as buttons and lack of input confirmation information are drawbacks associated with a typical conventional touch-sensitive panel.

## SUMMARY

**[0005]** A method and an electronic interface device capable of providing fixed relief information on a touch panel with locating features are disclosed. The device, in one embodiment, includes a haptic mechanism and a touch-sensitive surface. The haptic mechanism provides haptic feedback in response to an activating command. The activating command can be initiated by a user or a logic device. The touch-sensitive surface is capable of changing its surface texture from a

first surface characteristic to a second surface characteristic in response to the activating command. For example, the first surface characteristic may include a coarse texture while the second surface characteristic may include a smooth texture. In an alternative embodiment, the touch-sensitive surface includes a touch surface layer and a touch screen layer, wherein the touch screen layer senses inputs from touching.

**[0006]** Additional features and benefits of the exemplary embodiment(s) of the present invention will become apparent from the detailed description, figures and claims set forth below.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0007]** The exemplary embodiment(s) of the present invention will be understood more fully from the detailed description given below and from the accompanying drawings of various embodiments of the invention, which, however, should not be taken to limit the invention to the specific embodiments, but are for explanation and understanding only.

**[0008]** FIG. 1A is a block diagram illustrating a fixed relief display having one or more programmable relief functionalities in accordance with one embodiment of the present invention;

**[0009]** FIG. 1B is a block diagram illustrating multiple regions having programmable relief information functionalities in accordance with one embodiment of the present invention;

**[0010]** FIG. 1C is a three-dimensional ("3-D") block diagram illustrating an interface device having a deformable haptic surface capable of providing locating features in accordance with one embodiment of the present invention;

**[0011]** FIG. 1D is another example of 3-D block diagram illustrating an interface device having a deformable haptic surface with multiple independent regions in accordance with one embodiment of the present invention;

**[0012]** FIG. 2A is a cross-section diagram illustrating an interface device having a deformable haptic surface on a touch screen in accordance with one embodiment of the present invention;

**[0013]** FIG. 2B is a cross-section diagram illustrating an interface device capable of providing locating features using a set of openings on a touch screen in accordance with one embodiment of the present invention;

**[0014]** FIG. 2C is a cross-section diagram illustrating an interface device employing a lateral displacement haptic mechanism to provide locating features in accordance with one embodiment of the present invention;

**[0015]** FIG. 2D is a cross-section diagram illustrating a deformable haptic surface employing a push and pull haptic mechanism to provide locating features in accordance with one embodiment of the present invention;

**[0016]** FIG. 3(a-b) illustrates a haptic cell in an interface device using piezoelectric materials to generate haptic effects in accordance with one embodiment of the present invention;

**[0017]** FIG. 4(a-b) is a diagram illustrating another embodiment of a haptic cell using Micro-Electro-Mechanical Systems ("MEMS") device to generate haptic effects in accordance with one embodiment of the present invention;

**[0018]** FIG. 5(a-b) illustrates a side view of an interface device having an array of haptic cells with thermal fluid pockets in accordance with one embodiment of the present invention;